UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Loads (TMDLs) report for the primary contact (bacteria) and aquatic life use impairments in the Middle River and Upper South River Watersheds. The TMDLs were submitted to EPA for review in April 2004. The TMDLs were established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address an impairment of water quality as identified in Virginia's 1998 Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDLs for the primary contact and aquatic life use impairments satisfy each of these requirements.

Following the approval of the TMDLs, Virginia shall incorporate the TMDLs into the appropriate Water Quality Management Plans pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

Decision Rationale

**Total Maximum Daily Loads for
the Primary Contact (Bacteriological) and Aquatic Life Use Impairments on
Middle River and Upper South River Watersheds**

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA's) rationale for approving the TMDLs for the primary contact (bacteriological) and aquatic life use impairments on the Upper Middle River, Lower Middle River, Christians Creek, Moffett Creek, Lewis Creek, Polecat Draft, and Upper South River. EPA's rationale is based on the determination that the TMDLs meet the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDLs are designed to implement applicable water quality standards.
2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDLs consider the impacts of background pollutant contributions.
4) The TMDLs consider critical environmental conditions.
5) The TMDLs consider seasonal environmental variations.
6) The TMDLs include a margin of safety.
7) There is reasonable assurance that the TMDLs can be met.
8) The TMDLs have been subject to public participation.

II. Background

The Middle River and Upper South River Watersheds are located in Augusta County, Virginia. Christians Creek, Lewis Creek, Moffett Creek, and Polecat Draft are all tributaries to the Middle River which in turn is a tributary to the North River. The South River and North River form the South Fork of the Shenandoah River at their confluence. The impaired segments of Christians Creek, Lewis Creek, Moffett Creek and Polecat Draft all begin at the headwaters and continue to their confluence with Middle River. Two segments of the Middle River are listed as impaired. The Upper South River is listed as impaired as well. All of the above mentioned segments with the exception of Polecat Draft, Upper South River and Lower Middle River were listed for both bacteriological and benthic impairments. Forested and agricultural

lands made up over 90 percent of the land area in each watershed.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed the Upper South River, Middle River and its tributaries, mentioned above on Virginia's 1998 Section 303(d) list, as being unable to attain the primary contact and/or aquatic life uses. The decision to list these waters was based on observed violations of the Commonwealth's bacteriological criteria and assessments of the biological assemblage. At the time of its listing, the bacteria criteria used fecal coliform as an indicator species and had an instantaneous standard 1,000 colony forming units (cfu) per 100 milliliters (ml) and geometric mean standard of 200 cfu/100ml. This decision rationale will address the TMDLs for all of the impairments with the exception of the bacteriological impairment on Christians Creek (completed in 2002) and the benthic impairment on Lewis Creek.

Fecal coliform is a bacterium which can be found within the intestinal tract of all warm blooded animals. Fecal coliform in itself is not a pathogenic organism. However, fecal coliform indicates the presence of fecal wastes and the potential for the existence of other pathogenic bacteria. The higher concentrations of fecal coliform indicate the elevated likelihood of increased pathogenic organisms.

EPA encouraged the states to use e-coli and enterococci as the indicator species instead of fecal coliform. A better correlation was drawn between the concentrations of e-coli and enterococci, and the incidence of gastrointestinal illness. The Commonwealth adopted e-coli and enterococci criteria in January 2003. According to the new criteria, streams will be evaluated via the e-coli and enterococci criteria after 12 samples have been collected using these indicator species. Twelve e-coli samples were collected from these waters.

As Virginia designates all of its waters for primary contact, all waters are required to meet the bacteriological standard for primary contact. Virginia's standard applied to all streams designated as primary contact for all flows. The e-coli criteria requires a geometric mean concentration of 126 cfu/100ml of water with no sample exceeding 235 cfu/100ml of water. Unlike the fecal coliform criteria, which allows for a 10 percent violation rate, the new e-coli criteria requires the concentration of e-coli not exceed 235 cfu/100ml of water.

Although the TMDL and criteria require the 235 cfu/100ml of water concentration limit not be exceeded, waters are not placed on the Section 303(d) list if their violation rate does not exceed 10 percent. Therefore, the Middle River and its impaired tributaries and the Upper South River may be deemed as attaining the primary contact use prior to the implementation of all of the TMDL reductions. It is necessary to keep this in mind because of the reductions required to attain the instantaneous criteria for e-coli in the model. One severe exceedance of the instantaneous criteria in the model can drive the reductions as the standard is written to be attained on all flows.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment

Protocol II (RBPII) to determine the status of a stream's benthic macroinvertebrate community.[1] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[2] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired, after an RBPII evaluation, are classified as impaired and are placed on the Section 303(d) list of impaired waters. Middle River, Lewis Creek, Moffett Creek, and Christians Creek were assessed as moderately or severely impaired during the 1998 assessment period. The condition of the benthic community on Christians Creek has improved since then, with the most recent assessments showing a slightly to nonimpacted condition. However, a TMDL was required for Christians Creek as well.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is causing the degradation of the benthic community. Additional analysis is required to determine the pollutants which are causing the impairment. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.[3] A reference watershed approach was used to determine the endpoints for Middle River and its biologically impaired tributaries. Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the TMDL which will allow the impaired water to attain its designated use. A reference watershed approach is based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards. Separate reference watersheds were chosen for Moffett Creek, Upper Middle River and Christians Creek. A TMDL was not developed for the biological impairment on Lewis Creek.

Since the state is switching to the SCI for biological assessments, the TMDL modelers evaluated Middle River, Moffett Creek and Christians Creek based on the SCI. Unlike the RBPII analysis, the SCI has a scoring system based on a statistical analysis of a large benthic

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[1]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[2]Ibid 1

[3]Ibid 1

database.[4] Therefore, the SCI does not evaluate the benthic community on a one to one basis but evaluates the monitored community against the condition of several nonimpaired waters at once. The benthic scores using the SCI resembled the assessments through RBPII.

The TMDLs submitted by Virginia are designed to determine the acceptable load of e-coli which can be delivered to the impaired segment, as demonstrated by the Hydrologic Simulation Program Fortran (HSPF)[5], in order to ensure that the water quality standard is attained and maintained. HSPF is considered an appropriate model to analyze the impaired waters because of its dynamic ability to simulate both watershed loading and receiving water quality over a wide range of conditions. The model was run to determine the e-coli loading to the impaired segments within the Middle River watershed and the Upper South River. A translator equation was used to convert fecal coliform results to e-coli.

The TMDL analysis allocates the application/deposition of fecal coliform to land based and instream sources. For land based sources, the HSPF model accounts for the buildup and washoff of pollutants from these areas. Buildup (accumulation) refers to all of the complex spectrum of dry-weather processes that deposit or remove (die-off) pollutants between storms.[6] Washoff is the removal of pollutants which occurs as a result of runoff associated with storm events. These two processes allow the model to determine the amount of bacteria from land based sources which is reaching the stream. Point sources and wastes deposited directly to the stream were treated as direct deposits. Wastes which are deposited directly to the stream do not need a transport mechanism.

Local rainfall and temperature data were needed to develop the HSPF model. Weather data provides the rainfall data which drives the TMDL model. Weather data was obtained from the weather stations in Augusta County including station 448062.

Stream flow data was available from United States Geological Survey (USGS) gauges (01625000 and 01626000) on Middle River and South River. The hydrologic models were calibrated and validated against observed flow data from these gauges. The benthic TMDLs were developed using the Generalized Watershed Loading Function model (GWLF). The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[7] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance

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[4]MapTech, 2004, General Standard Total Maximum Daily Load Development for Unnamed Tributary to Deep Creek.

[5]Tetra Tech, 2004. Total Maximum Daily Load (TMDL) Development for Smith Creek

[6]CH2MHILL, 2000. Fecal Coliform TMDL Development for Cedar, Hall, Byers, and Hutton Creeks Virginia.

[7]Ibid 1

calculations.[8] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. A reference watershed approach was used to determine the allowable sediment load to each watershed. Since the size of the watershed impacts the amount of sediment it is able to assimilate, the reference watersheds were increased or reduced to the size of the monitored watershed. The reference watershed adjustments were conducted so that the landuse distributions remained consistent. Table 1 summarizes the TMDL loadings for these waters.

Through the development of these and other similar TMDLs, it was discovered that natural conditions (wildlife contributions to the streams) could cause or contribute to violations of the bacteria criteria. According to the models, wildlife reductions were necessary to attain the bacterial standard in these waters. Bacteria source tracking data collected in the watershed, indicated that bacteria from wildlife represents a significant portion of the total load, which confirmed the model results. Many of Virginia's TMDLs, including the TMDLs for the Middle River and its impaired tributaries and the South River, have called for some reduction in the amount of wildlife contributions to the impacted streams. EPA believes that a significant reduction in wildlife is not practical and will not be necessary due to the implementation plan discussed below.

A phased implementation plan will be developed for all streams in which the TMDL calls for reductions in wildlife. In Phase 1 of the implementation, the Commonwealth will begin implementing the reductions (other than wildlife) called for in the TMDL. In Phase 2, which can occur concurrently to Phase 1, the Commonwealth will consider addressing its standards to accommodate this natural loading condition. The Commonwealth has indicated that during Phase 2, it may develop a Use Attainability Analysis (UAA) for streams with wildlife reductions which are not used for frequent bathing. Depending upon the result of the UAA, it is possible that these streams could be designated for secondary contact.

After the completion of Phase 1 of the implementation plan, the Commonwealth will monitor the stream to determine if the wildlife reductions are actually necessary, as the violation level associated with the wildlife loading may be smaller than the percent error of the model. In Phase 3, the Commonwealth will investigate the sampling data to determine if further load reductions are needed in order for these waters to attain standards. If the load reductions and/or the new application of standards allow the stream to attain standards, then no additional work is warranted. However, if standards are still not being attained after the implementation of Phases 1 and 2, further work and reductions will be warranted. It should be noted that the reductions necessary to attain a 10 percent violation rate of the standard, which is the threshold for Section 303(d) listing, would require less stringent reductions.

Table 1 - Summarizes the Specific Elements of the TMDLs.

[8]Ibid 1

Segment	Parameter	TMDL	WLA	LA	MOS
Upper Middle River	E-Coli (cfu/yr)	3.36E+13	5.05E+09	3.36E+13	Implicit
Upper Middle River	Sediment (tons/yr)	6,316	1.355	5,683	632
Moffett Creek	E-Coli (cfu/yr)	5.39E+12	0.00	5.39E+09	Implicit
Moffett Creek	Sediment (tons/yr)	4,067	0.00	3,660	407
Lewis Creek	E-Coli (cfu/yr)	6.97E+12	3.48E+09	6.96E+12	Implicit
Polecat Draft	E-Coli (cfu/yr)	2.61E+12	0.00	2.61E+12	Implicit
Lower Middle River	E-Coli (cfu/yr)	1.00E+14	1.22E+13	8.80E+13	Implicit
South River	E-Coli (cfu/yr)	2.03E+13	1.06E+11	2.02E+13	Implicit

Christians Creek	Sediment (tons/yr)	6,168	145	5,406	617

The United States Fish and Wildlife Service has been provided with a copy of these TMDLs.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing a primary contact (bacteriological) and aquatic life (benthic) use impairment TMDLs for the Middle River and its impaired tributaries and the South River. EPA is therefore approving these TMDLs. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDLs are designed to meet the applicable water quality standards.

Virginia has indicated that excessive levels of fecal coliform due to nonpoint sources (both wet weather and directly deposited nonpoint sources) have caused violations of the water quality criteria and designated uses in the Middle River and South River. The water quality criterion for fecal coliform was a geometric mean 200 cfu/100ml or an instantaneous standard of no more than 1,000 cfu/100ml. Two or more samples over a thirty-day period are required for the geometric mean standard. Since the state rarely collects more than one sample over a thirty-day period, most of the samples were measured against the instantaneous standard.

The Commonwealth changed its bacteriological criteria as indicated above. The new criteria require the fecal coliform concentration not exceed a geometric mean of 200 cfu/100ml of water for two or more samples collected over a month nor shall more than 10 percent of the total samples exceed 400 cfu/100ml of water. The new e-coli criteria requires a geometric mean of 126 cfu/100ml of water with no sample exceeding 235 cfu/100ml. In order for the water to attain criteria, it cannot have a e-coli concentration above 235 cfu/100ml. Therefore, if the model documents a simulated concentration of 23,500 cfu/100 a 99 percent reduction in the concentration is required.

The HSPF model was used to determine the fecal coliform deposition rates to the land as well as loadings to the stream from direct deposit sources. Once the existing load was determined, allocations were assigned to each source category to develop a loading pattern that would allow the Middle River (including the impaired tributaries) and South River to support the e-coli water quality criterion and primary contact use. The following discussion is intended to describe how controls on the loading of e-coli to these streams will ensure that the criterion is attained.

The TMDL modelers determined the fecal coliform production rates within the

watersheds. Data used in the model was obtained from a wide array of sources, including farm practices in the area, the amount and concentration of farm animals, animal access to the stream, wildlife populations, wildlife fecal production rates, landuses, weather, stream geometry, etc.. The model combined all of the data to determine the hydrology and water quality of the streams.

The lands within the watersheds were categorized into specific landuses. The landuses had specific loading rates and characteristics that were defined by the modelers. Therefore, the loading rates were different in lands defined as forested versus pasture. Pasture lands support cattle and were influenced differently by stormwater runoff. The amount of cattle on the land, the time cattle spent on the land, and how much waste the cattle generated impacted the loading rate.

The Middle River and South River TMDL models were run using weather data collected from weather stations in Augusta County. This data was used to determine the precipitation rates in the watershed which transports the on land pollutants to the streams through overland and groundwater flows. Wastes that were deposited to the land were subjected to a die-off rate. The longer fecal coliform stayed on the ground the greater the die-off. Materials that were washed off the surface shortly after deposition were subjected to less die-off.

Stream flow data was available for both waters. Therefore, simulated stream flow of the model could be compared directly to observed flow data. The flows for the Middle River and its tributaries were calibrated to flows from USGS gauge 01625000 on the Middle River while the South River TMDL was developed to flows from USGS gauge 01626000 on the South River. The Middle River model was calibrated to observed flow data from September 1992 to July 1997. During the calibration period, the model parameters were adjusted until the simulated data accurately reflected the observed flow data. The model was validated against flow data from September 1985 to July 1990. During validation, the model parameters were held constant to insure that the model was accurately reflecting stream processes. The South River TMDL model was calibrated and validated to flow data from the same period.

After developing the hydrology models, loading parameters were developed for each model to determine the water quality of the streams. The water quality models were calibrated to the observed water quality for each impaired segment. The calibration period for the Upper South River was October 1997 through 2002 while the Middle River impairments were calibrated to data collected from September 1992 to October 1997. The model simulated the hydrology and water quality of the rivers. Therefore, when the loadings were adjusted to represent the various allocation scenarios they were predicting, the bacteria concentrations would be under these conditions.

The biological assessments on the biologically impaired waters (Christians Creek, Moffett Creek, Upper Middle River and Lewis Creek) were not able to discern a clear stressor to the Creeks. The TMDL modelers, therefore, conducted a stressor identification analysis to determine what was impacting the benthic communities on these streams. Ambient water quality data was compared to numeric water quality criteria and ambient water quality data from reference watersheds. This analysis was able to rule out dissolve oxygen, temperature, nutrients,

pH or toxics as the stressors to Moffett Creek and the Upper Middle River. Christians Creek may be impacted by toxics although it is believed to be a secondary stressor if it is impacting the system at all. A stressor was not fully identified for Lewis Creek and the stream will need to be revisited. Sediment was seen as the stressor of concern to Moffett Creek, Christians Creek, and Upper Middle River. Excessive sediment loadings can destroy critical habitat areas, clog an organisms gills and respiratory ability, and lower the in-stream visibility for predators. Excessive sediment can come from the watershed or the stream banks themselves.

Stream banks with rich riparian vegetation are more stable as the root systems of the trees and shrubs hold onto the sediment and prevent its movement to the stream. The vegetation along the stream bank also provides forage material for the benthic organisms and shading which can protect the stream from excessive temperatures. Therefore, streams with poorly vegetated banks are impacted in several ways. It is believed that a lack of forage material due to the absence of riparian vegetation is a major contributor to the benthic impairment on Christians Creek.

The GWLF model was used to determine the loading rates of sediment to the impaired and reference watersheds from all point and nonpoint sources. The TMDL modelers determined the sediment loading rates within each watershed. Data used in the model was obtained on a wide array of items, including landuses in the area, point sources in the watershed, weather, stream geometry, etc..

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[9] To equate the reference watersheds with the impaired watersheds, the size of the reference watersheds was adjusted to that of the impaired watershed. Each landuse was adjusted in equal proportion, insuring that the landuse breakdown in the reference watersheds remained constant. Local rainfall and temperature data were needed to simulate the hydrology, and was obtained weather stations within the appropriate watersheds. The models were also calibrated to stream flow data, the impaired waters were all calibrated to data from Christians Creek while the reference waters were modeled to gauge data collected from them. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of agricultural land, land slope, soil erodibility, and farming practices used in the area.[10] Parameters within the model account for these conditions and practices. The sediment load to impaired waters was reduced to match the load of their area adjusted reference water.

2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

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[9]Ibid 1

[10]Ibid 1

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of bacteria to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There are roughly 50 permitted dischargers operating in these waters however only a small portion of these facilities are able to discharge the pollutant of concern to the impaired water. There are 24 dischargers permitted to contain sediment in their effluent in Christians Creek. There are two dischargers permitted to contain sediment in the their effluent in the Upper Middle River. There is a total of 15 dischargers that are permitted to contain e-coli in their effluent within the Upper and Lower Middle River, Moffett Creek, Lewis Creek, Polecat Draft and the South River. For nonstormwater permits the waste load allocation (WLA) can be determined by multiplying the facilities flow by its concentration limit by 365 days after making the appropriate unit conversion. For stormwater facilities the model determined the flow and the WLA can be determined by multiplying that flow by the concentration by 365 day after making the appropriate unit conversions.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table 2 - WLAs for the Middle and South River TMDLs

Stream	Permit Number	Facility	Pollutant	WLA
Upper Middle River	VA0060917	Camp Shenandoah STP	E-Coli (cfu/yr)	5.05E+09
	VA0060917		Sediment (tons/yr)	0.180
	VA0091219	Casta Line Trout Farms	Sediment (tons/yr)	1.175
Lower Middle River	VA0022322	ASCA Mt. Sydney Ft Defiance STP	E-Coli (cfu/yr)	2.61E+11
	VA0062481	ASCA-New Hope STP	E-Coli (cfu/yr)	6.09E+10
	VA0064793	Middle River Regional STP	E-Coli (cfu/yr)	1.18E+13
	VA0084212	ACSA-Churchville WTP	E-Coli (cfu/yr)	5.22E+09
	VAG401064	Single Family Unit	E-Coli (cfu/yr)	1.74E+09

	VAG401312	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
	VAG401359	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
	VAG401498	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
	VAG401664	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
	VAG401915	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
Lewis Creek	VAG401072	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
	VAG401882	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
South River	VA0023400	Cold Spring Correctional Unit 10	E-Coli (cfu/yr)	1.04E+11
	VAG401981	Single Family Unit	E-Coli (cfu/yr)	1.74E+09
Christians Creek	VA0025291	Fishersville STP	Sediment (tons/yr)	99.483
	VA0089061	Woodlawn Village Mobile	Sediment (tons/yr)	2.425
	VA0090417	Greenville WWTP	Sediment (tons/yr)	15.545
	VAG401896	Victory Worship Center	Sediment (tons/yr)	0.041
	VAG401967	Amoco/Deno's Food Mart	Sediment (tons/yr)	0.041
	VAG401969	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401960	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401959	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401449	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401443	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401195	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401082	Single Family Unit	Sediment (tons/yr)	0.41
	VAG401979	Single Family Unit	Sediment (tons/yr)	0.41
	VAG408038	Single Family Unit	Sediment (tons/yr)	0.41
	VAR100595	Pilot Travel Center 96	Sediment (tons/yr)	0.785
	VAR102392	Countryside Development	Sediment (tons/yr)	6.085
	VAR101656	Shields Construction Co.	Sediment (tons/yr)	7.224
	VAR101657	Teaberry Green	Sediment (tons/yr)	0.840
	VAR101710	VDOT Verona	Sediment (tons/yr)	0.538
	VAR101719	Augusta County Commercial Center	Sediment (tons/yr)	1.806
	VAR101725	Harley Crossing	Sediment (tons/yr)	0.895
	VAR101780	VDOT-Verona	Sediment (tons/yr)	0.094

	VAR051334	FedEx East Inc.	Sediment (tons/yr)	0.790
	VAR051405	Augusta Regional Landfill	Sediment (tons/yr)	8.148

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), load allocations (LAs) are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings, VADEQ used the HSPF model to represent the impaired watersheds. The HSPF model is a comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. HSPF uses precipitation data for continuous and storm event simulation to determine the total loading to the impaired segments from the various landuses within the watershed. Tables 3a through 3f list the LAs for bacteria for the Middle and South River TMDLs. The reductions needed to insure that the instantaneous criteria is attained at all times is extremely stringent. A Stage 1 implementation was developed with the TMDL with more attainable reductions in the loadings.

For the sediment TMDL the GWLF model was used to ascertain the sediment loading to impaired waters. This model provides the monthly sediment load to the stream through the use of the universal soil loss equation (USLE). The USLE derives the sediment loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Table 3g through 3i lists the LAs for Middle River benthic TMDLs.

Table 3a - LA for Bacteria (fecal coliform) for Upper Middle River

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	1.42E+14	1.42E+11	99.9
Farmstead	1.88E+13	1.88E+10	99.9

Cropland	1.23E+16	1.23E+13	99.9
Livestock Access	7.70E+14	7.70E+11	99.9
Pasture	1.03E+16	1.03E+13	99.9
Livestock Operations	6.89E+12	6.89E+09	99.9
Forest	1.12E+15	1.12E+13	99
Livestock Direct Deposit	1.89E+14	0.00	100
Wildlife Direct Deposit	6.13E+13	6.13E+13	0
Straight Pipes	1.33E+12	0	100

Table 3b - LA for Bacteria (fecal coliform) for Moffett Creek

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	2.86E+13	2.86E+10	99.9
Farmstead	1.18E+13	1.18E+10	99.9
Cropland	7.44E+15	7.44E+12	99.9
Livestock Access	2.58E+14	2.58E+11	99.9
Pasture	4.01E+15	4.01E+12	99.9
Livestock Operations	4.31E+11	4.31E+08	99.9
Forest	3.88E+14	2.72E+13	93
Livestock Direct Deposit	6.66E+13	0	100

Wildlife Direct Deposit	1.84E+13	1.18E+13	36
Straight Pipes	3.07E+11	0	100

Table 3c - LA for Bacteria (fecal coliform) for Lewis Creek

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	6.31E+14	6.31E+11	99.9
Farmstead	3.38E+12	3.38E+09	99.9
Cropland	5.54E+15	5.54E+12	99.9
Livestock Access	2.23E+14	2.23E+11	99.9
Pasture	2.30E+15	2.30E+12	99.9

Livestock Operations	5.35E+09	5.35E+06	99.9
Forest	1.70E+14	1.70E+12	90
Livestock Direct Deposit	4.14E+03	0	100
Wildlife Direct Deposit	1.97E+13	4.93E+12	75
Straight Pipes	4.39E+11	0	100

Table 3d - LA for Bacteria (fecal coliform) for Polecat Draft

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	1.55E+13	2.79E+12	82
Farmstead	2.63E+12	4.74E+11	82

Cropland	2.23E+15	2.23E+11	99.99
Livestock Access	8.84E+13	8.84E+09	99.99
Pasture	1.41E+15	1.41E+11	99.99
Livestock Operations	7.91E+10	7.91E+06	99.99
Forest	3.47E+13	3.47E+13	90
Livestock Direct Deposit	2.18E+13	0	100
Wildlife Direct Deposit	5.82E+12	5.47E+12	6
Straight Pipes	6.15E+10	0	100

Table 3e - LA for Bacteria (fecal coliform) for Lower Middle River

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	7.49E+13	7.49E+11	99
Farmstead	1.06E+13	1.06E+11	99
Cropland	2.18E+16	2.18E+13	99.9
Livestock Access	6.45E+14	6.45E+11	99.9
Pasture	9.64E+15	9.64E+12	99.9
Livestock Operations	8.57E+10	8.57E+07	99.9
Forest	2.34E+14	6.79E+13	71
Livestock Direct Deposit	2.03E+14	0	100

Wildlife Direct Deposit	7.26E+15	7.26E+15	0
Straight Pipes	1.93E+11	0	100

Table 3f - LA for Bacteria (fecal coliform) for Upper South River

Source Category	Existing Load (cfu/yr)	Proposed Load (cfu/yr)	Percent Reduction
Residential & Commercial	1.70E+14	1.70E+11	99.9
Farmstead	1.23E+13	1.23E+10	99.9
Cropland	1.85E+15	1.85E+12	99.9
Livestock Access	2.80E+14	6.45E+11	99.9
Pasture	3.11E+15	3.11E+12	99.9

Livestock Operations	3.30E+11	3.30E+08	99.9
Forest	7.80E+14	1.59E+13	97.5
Livestock Direct Deposit	1.77E+15	7.97E+14	55
Wildlife Direct Deposit	3.37E+13	3.37E+13	0
Straight Pipes	2.57E+12	0	100

Table 3g - LA for Sediment for Moffett Creek

Source Category	Existing Load (tons/yr)	Proposed Load (tons/yr)	Percent Reduction
Developed	.966	.966	0
Transitional	1.174	1.174	0
Forest	177.686	177.686	0
Pasture	8,385	2,851	66
Cropland	1,019	611	40
Channel Erosion	5.389	5.389	0

Table 3h - LA for Sediment for Upper Middle River

Source Category	Existing Load (tons/yr)	Proposed Load (tons/yr)	Percent Reduction
Developed	1.9	1.9	0
Transitional	188.77	188.777	0
Forest	173.249	173.249	0

Pasture	10,355	4,504	56.5
Cropland	1,439	676	53
Channel Erosion	4.648	4.648	0

Table 3i - LA for Sediment for Christians Creek

Source Category	Existing Load (tons/yr)	Proposed Load (tons/yr)	Percent Reduction
Developed	.09	.09	0
Transitional	0	0	0
Forest	1.281	1.281	0
Pasture	108.771	108.771	0
Cropland	19.190	19.190	0
Channel Erosion	7,173	5,139	28

3) The TMDLs consider the impacts of background pollution.

The TMDLs consider the impact of background pollutants by considering the bacteria load from background sources like wildlife and the sediment load from forests.

4) The TMDLs consider critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the Middle River and its impaired tributaries and the South River are protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[11]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

[11]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

The HSPF and GWLF models for the impaired waters were run over a multi-year period to insure that they accounted for a wide range of climatic conditions. The allocations developed in the TMDLs, therefore, insures that the criteria will be attained over a wide range of environmental conditions including wet and dry weather conditions.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods.

Bacteria loadings also change during the year based on crop cycles, waste application rates, and cattle access patterns. Sediment loadings change based on vegetative cover and weather conditions which change with the seasons. Consistent with our discussion regarding critical conditions, the TMDLs for Middle River and its impaired tributaries and South River effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia included an implicit MOS in the bacteria TMDLs through the use of conservative modeling assumptions in the determination of bacteria loadings and production. An explicit MOS of 10 percent was used for the sediment TMDLs.

7) There is a reasonable assurance that the TMDLs can be met.

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDLs have been subject to public participation.

Five public meetings were held in association with the development of these TMDLs. The meetings were held on March 5, 2003, October 7, 2003, December 3, 2003,

January 29, 2004 and March 25, 2004. All of the meetings were held in the Augusta County Government Center Board Room in Verona, Virginia, with the exception of the October meeting which was held in the Woodrow Wilson Rehabilitation Center in Fisherville, Virginia. Between 15 and 63 people attended the meetings which were all noticed in the *Virginia Register*. A thirty-day public comment period was associated with each meeting and written comments were received after the last meeting. VADEQ responded to all of the written comments.